Peak-Seeking Control for Trim Optimization

Completed Technology Project (2014 - 2015)

Project Introduction

Innovators have developed a peak-seeking algorithm that can reduce drag and improve performance and fuel efficiency by optimizing aircraft trim in real time. The algorithm determines a unique trim position for an aircraft by employing a time-varying Kalman filter to estimate the gradient of a performance function using in-flight measurements. Existing trim control systems pre-program position data into an aircraft's computer, based on knowledge gained from test flights and wind tunnel experiments. In contrast, this innovation determines in real time the most fuel-efficient trim surface position by taking into account actual flight conditions and an aircraft's physical condition. This customized approach results in maximum fuel efficiency for each particular aircraft.

Work to date: The Dryden team has validated the algorithm with a series of F-18 experiments.

Looking ahead: Future flight research efforts will work to further mature the technology and transition it to other aircrafts. For example, the team is current working with the U.S. Navy to study the potential benefits and costs of implementing the technology on the Super Hornet military aircraft. The group is also talking with the Navy and Lockheed Martin about testing the technology on the F-35 fighter jet.

Benefits

- **Fuel-efficient:** Reduces fuel consumption and extends the operating range of aircrafts
- **Fast**: Determines and maintains the optimum trim surface position solution with 5 minutes, despite disturbances and other noise
- **Customized**: Determines unique trim position using in-flight measurements
- **Variable**: Works on multiple effectors in multiple axes simultaneously

Applications

- Military jets
- Commercial airlines

Anticipated Benefits

N/A

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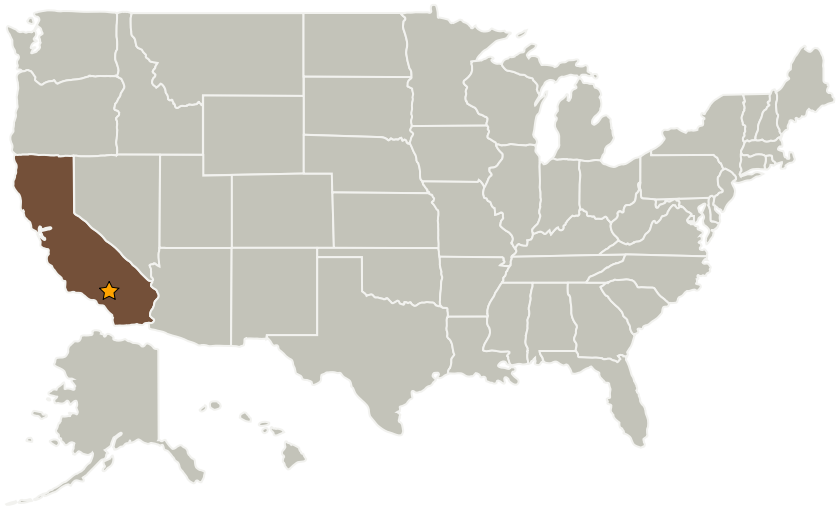
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★Armstrong Flight Research Center(AFRC)	Lead Organization	NASA Center	Edwards, California

Primary U.S. Work Locations
California

Stories

Intelligent Control for Performance Success story
(https://techport.nasa.gov/file/26263)

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Armstrong Flight Research Center (AFRC)

Responsible Program:

Center Innovation Fund: AFRC CIF

Project Management

Program Director:

Michael R Lapointe

Program Manager:

David F Voracek

Principal Investigator:

Nelson A Brown

Co-Investigator:

Jacob R Schaefer

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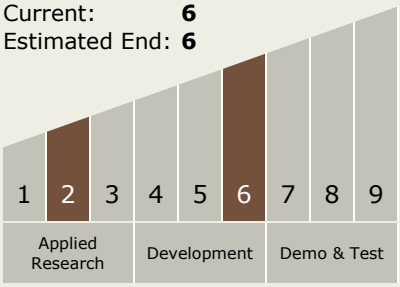
Technology Maturity (TRL)

Start: **2**
Current: **6**
Estimated End: **6**



Technology Areas

Primary:

- TX15 Flight Vehicle Systems
  - TX15.1 Aerosciences
    - TX15.1.6 Advanced Atmospheric Flight Vehicles